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09/891,200	06/26/2001	Eugene S. Smotkin	491712000100	9382

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EXAMINER

ALEJANDRO, RAYMOND

ART UNIT

PAPER NUMBER

1745

DATE MAILED: 08/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/891,200

Applicant(s)

SMOTKIN, EUGENE S.

Examiner

Raymond Alejandro

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-62 is/are pending in the application.
- 4a) Of the above claim(s) 2,4-30,34-43,45 and 47-62 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,31-33,44 and 46 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☒ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election of Group I and Species I (claims 1, 3, 31-33, 44 and 46) in Paper No. 7 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

### *Priority*

2. Applicant's claim for domestic priority under 35 U.S.C. 119(e) and 120 is acknowledged.

3. It is noted that this application appears to claim subject matter disclosed in prior Application No. "Attorney Docket No. 491712000140, filed 06/22/01". A reference to the prior application must be inserted as the first sentence of the specification of this application or in an application data sheet (37 CFR 1.76), if applicant intends to rely on the filing date of the prior application under 35 U.S.C. 119(e) or 120. See 37 CFR 1.78(a). For benefit claims under 35 U.S.C. 120, the reference must include the relationship (i.e., continuation, divisional, or continuation-in-part) of all nonprovisional applications and clearly identify their serial numbers in the specification or application date sheet. Also, the current status of all nonprovisional parent applications referenced should be included.

### *Information Disclosure Statement*

4. The information disclosure statement (IDS) submitted on 06/26/01 (paper # 2) was considered by the examiner.

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***Oath/Declaration***

5. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because it does not clearly identify the application serial number from which benefit under 35 USC 120 is being claimed. In that, it is noted that both the declaration and the application data sheet list the attorney docket number of the application.

***Drawings***

6. The sheets of drawings, filed on 06/26/01 have been accepted.

***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 1, 3, 31, 44 and 46 are rejected under 35 U.S.C. 102(b) as being anticipated by the publication “Solid-State protonic conductors: principles, properties, progress and prospects” by T.Norby (hereinafter referred to as “the Norby’s publication”).

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The present application is directed to an electronically insulating proton conductor wherein the disclosed inventive concept comprises the specific working temperature. Other limitations include the specific substrate material.

With respect to claims 1, 3, 44 and 46:

9. The Norby's publication teaches a solid-state protonic conductor (TITLE) which can be used in a fuel cell (ABSTRACT). It is disclosed that protonic conductivity are candidates for electrolyte in fuel cells (INTRODUCTION) *Thus, the electronically insulating and energy converting properties are inherent to the protonic conductor material per se. Accordingly, products of identical chemical composition can not have mutually exclusive properties, and thus, the claimed property i.e. capable of converting chemical energy as well as being electronically insulating, is necessarily present in the prior art material.*

The Norby's publication shows in **Figure 1** an overview of proton conductivities for selected materials as a function of temperature (FIGURE 1). The plot illustrates data for proton conductivity as a function of inverse temperature wherein 1) BCN 18, 2) BYSO, 3) Y:BaCeO<sub>3</sub>, 4) Y:BaZrO<sub>3</sub>, 5) CsHSO<sub>4</sub>, 6) IISAP, 7) Nafion 117, 8) H<sub>3</sub>PO<sub>4</sub> are suitable protonic conductors under working temperatures (inverse temperature) ranging from 0.0018 to .0045 T<sup>-1</sup> (*equivalent to approximately 220-550 °C*) (SEE FIGURE 1).

*Thus, the proton conducting material is capable of converting chemical energy of a reaction into electrical energy at the claimed (i.e. a temperature of about 220-550 °C.*

With respect to claim 31:

The Norby's publication reveals that Ba<sub>3</sub>Ca<sub>1.18</sub>Nb<sub>1.82</sub>O<sub>8.73</sub> (BCN18) shows proton conduction (PROPERTIES, pages 4-6).

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*Examiner's Note: As to the specific preamble reciting "of a membrane electrode assembly", it is pointed out that the preamble refers to intended use. That is, the claim is directed to a proton conductor/conducting composite membrane and the foregoing preamble phrase is only a statement of ultimate intended utility.*

Thus, the claims are anticipated.

10. Claims 1, 3, 44 and 46 are rejected under 35 U.S.C. 102(e) as being anticipated by Hsu 6083636.

With respect to claims 1, 3, 44 and 46:

Hsu disclose a fuel cell system which can be operated at temperatures ranging between about 20-2000 °C (ABSTRACT/COL 3, lines 55-63/COL 14, lines 19-30):

[57]

**ABSTRACT**

A system and method for producing electricity with a fuel cell power system. The power system includes an assembly of fuel cell stacks that operate at different temperatures, which vary between two or more of the fuel cell stacks. The fuel cell stack can have multiple temperature regions formed axially along the stack, or a plurality of spatially separated fuel cell stacks can be employed to heat a reactant from an input temperature to a desired temperature. The fuel cell stacks have operating temperatures in the range between about 20° C. and about 2000° C.

It is disclosed that the fuel cell has electrolytes (Col 8, lines 40-55/ COL 19, lines 24-35):

The performance of each temperature region of the fuel cell stack can be maximized by forming each section of a material suitable for use at the operational temperature of the region. Exemplary electrolyte materials suitable for use in  
45 such a wide temperature range include solid state or solid oxide materials including yttria stabilized zirconia, lanthanum gallate, ceria based oxide, bismuth based oxide, or composites of anyone of the foregoing materials; and exemplary fuel cell types include solid oxide or solid state fuel  
50 cells, molten carbonate fuel cells, phosphoric acid fuel cells, alkaline fuel cells, and proton exchange membrane fuel cells. The portion of the fuel cell defined by each temperature section operates at a selected temperature, and hence has an associated suitable electrolyte material. Those of  
55 ordinary skill will readily recognize which of the foregoing materials are best suited for a particular temperature range.

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FIGS. 13 through 15 illustrate the basic cell unit 10 of the electrochemical converter 72, which is particularly suitable for integration with conventional gas turbines. The cell unit 10 includes an electrolyte plate 20 and an interconnector plate 30. In one embodiment, the electrolyte plate 20 can be made of a ceramic, such as a stabilized zirconia material  $\text{ZrO}_2(\text{Y}_2\text{O}_3)$ , on which a porous oxidizer electrode material 20A and a porous fuel electrode material 20B are disposed thereon. Exemplary materials for the oxidizer electrode material are perovskite materials, such as  $\text{LaMnO}_3(\text{Sr})$ . Exemplary materials for the fuel electrode material are cermets such as  $\text{ZrO}_2/\text{Ni}$  and  $\text{ZrO}_2/\text{NiO}$ .

Hsu teaches fuel cells having different operating temperatures (Col 14, lines 55-67).

According to another embodiment, fuel cells having different operating temperatures are aligned in a sequence of increasing temperate. The operating temperature of the fuel cell is between about  $20^\circ\text{C}$ . and about  $1500^\circ\text{C}$ ., and the preferred fuel cell types include proton membrane fuel cells, phosphoric acid fuel cells, alkaline fuel cells, molten carbonate fuel cells, and solid oxide fuel cells, or solid state fuel cells, which can be composed of yttria stabilized zirconia, lanthanum gallate, ceria based oxide, bismuth based oxide, or composites of anyone of the foregoing materials, all arranged in an ascending temperature order. FIG. 6 illustrates the use of an assembly of fuel cells, A, B, C, D of different operational temperatures. The illustrated graph 360

It is disclosed that each electrolyte plate 20 is typically an ionic conductor having low ionic resistance to allow transport of an ionic species (COL 7, lines 33-38).

*Examiner's Note: As to the specific preamble reciting "of a membrane electrode assembly", it is pointed out that the preamble refers to intended use. That is, the claim is directed to a proton conductor/conducting composite membrane and the foregoing preamble phrase is only a statement of ultimate intended utility. Moreover, the electronically insulating and energy converting properties are inherent to the protonic conductor material per se used in the fuel cell.*

Hsu further discloses that the fuel cells can be formed of selected materials appropriate for the operational temperatures at which the fuel cell is to operate. The fuel cells suitable for use

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includes at least solid oxide or solid state electrolytes, molten carbonate electrolytes, phosphoric acid electrolyte, or alkaline electrolyte (COL 12, lines 49-61).

Thus, the proton conducting electrolyte is capable of converting chemical energy of a reaction into electrical energy at the claimed (i.e. a temperature of about 220-550 °C) by adequately selecting any of the electrolyte materials mentioned above.

Thus, the claims are anticipated.

11. Claims 1, 3, 44 and 46 are rejected under 35 U.S.C. 102(e) as being anticipated by Crome et al 5985113.

As to claims 1, 3, 44 and 46:

Crome et al disclose a ceramic electrochemical apparatus which can be a fuel cell (TITLE/ABSTRACT) wherein the electrolyte is as follows (CLAIM 1 and 12):

WHAT IS CLAIMED IS:

1. An ionically conductive ceramic electrolyte element, comprising: 45
12. The ceramic electrolyte element of claim 1, wherein 20  
said ceramic electrolyte element includes an electrolyte from the group consisting of:  $Zr_{1-x}A_xO_2$ ,  $Ce_{1-x}A_xO_2$ ,  $(Bi_2O_3)_{1-x}(A_2O_3)_x$ ,  $Bi_2V_{1-x}A_xO_{5.5-3x/2}$  and  $La_{1-x}Sr_xGa_{1-y}Mg_yO_3$  and mixtures thereof wherein  $(0.00 < x < 0.30)$ ;  $(0.00 < y < 0.30)$  25  
and A Y, Yb, Sc, Ca, Mg, Sm, Gd, La, Sr, Nd, Er, Dy, Cu, Ti, Zr, Al, Co, Ni and a binder for binding the electrolyte during injection molding.

Examiner's Note: As to the specific preamble reciting "of a membrane electrode assembly", it is pointed out that the preamble refers to intended use. That is, the claim is directed to a proton conductor/conducting composite membrane and the foregoing preamble phrase is only a statement of ultimate intended utility. Moreover, the electronically insulating



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*and energy converting properties are inherent to the protonic conductor material per se used in the fuel cell.*

*Thus, the proton conducting electrolyte is capable of converting chemical energy of a reaction into electrical energy at the claimed (i.e. a temperature of about 220-550 °C) by adequately selecting any of the electrolyte materials mentioned above.*

Thus, the claims are anticipated.

### ***Claim Rejections - 35 USC § 103***

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Crome et al 5985113.

Crome et al is applied, argued and incorporated herein for the reasons above. In addition, Crome et al do not expressly disclose the specific proton conductor material. However, Crome et al also disclose the following:

As to claim 31:

Crome et al disclose the following (COL 9, lines 10-26):

For all described embodiments, it is envisioned that the electrolyte material can be selected from the following groups and mixtures thereof: 10

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- 5) lanthanum gallate  $\text{La}_{1-x}\text{Sr}_x\text{Ga}_{1-y}\text{Mg}_y\text{O}_3$  where <sup>25</sup>  
( $0 < x < 0.30$ ) (where  $x=0.10$  is preferred) and ( $0.00 < y < 0.30$ )  
(where  $y=0.20$  is preferred).

Crome et al also envision that the electrolyte material can be selected from a variety of element groups and mixtures thereof including scandium (Sc) (CLAIM 12/ COL 9, lines 10-26).

*Thus, it is asserted that scandium (Sc) can replace gallium (Ga) in the ceramic composite chemical formula.*

In view of this disclosure, it would have been obvious to one skilled in the art at the time the invention was made to make the proton conductor material of Crome et al by replacing gallium element Ga with scandium element (Sc) as Crome et al themselves teaches that, for all described embodiments, it is envisioned that the electrolyte material can be selected from a variety of groups and mixtures including an alternative use of scandium element (Sc). Thus, Crome et al directly teach that scandium (Sc) can be a doping element which might substitute or replace any element in electrolyte composite materials. Further, those of ordinary skill in the art knows that scandium (Sc) element may be a substitute element in composite materials as both elements Sc and Ga shows the same chemical valence.

14. Claims 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over the publication "Solid-State protonic conductors: principles, properties, progress and prospects" by T.Norby (hereinafter referred to as "the Norby's publication") as applied to claim 3 above, and further in view of the publication "Hydrogen-transparent metal surfaces produced by use of molten salts with very low oxygen and water activities" by Deublein et al (hereinafter referred to as "Deublein et al's publication").

The Norby's publication is applied, argued, and incorporated herein for the reasons above. However, the Norby's publication does not teach the specific metal hydride substrate.

The Deublein et al's publication teaches metal hydride materials not forming hydrogen blocking surface oxide layers in electrolyte environments (ABSTRACT). Such materials are palladium (Pd), LaNi<sub>5</sub>, titanium(Ti)-vanadium (V) (2<sup>nd</sup> and 3<sup>rd</sup> paragraph of the publication).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific metal hydride substrate of Deublein et al in the proton conductor material of Norby's publication as Deublein et al teach that these metal hydride substrates are material not forming hydrogen-blocking surface oxide layers in electrolyte environment. Accordingly, these materials are immune to reaction with the electrolytic environment and thus, do not form blocking interfacial oxide layers. Further, the reaction of metals and alloys with hydrogen is of great technical importance to a variety of current and potential industrial application as a fast reaction with hydrogen is desirable for the transport of hydrogen through membranes to separate it from other gases in fuel cell applications.

15. Claims 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu 6083636 as applied to claim 3 above, and further in view of the publication "Hydrogen-transparent metal surfaces produced by use of molten salts with very low oxygen and water activities" by Deublein et al (hereinafter referred to as "Deublein et al's publication").

Hsu is applied, argued, and incorporated herein for the reasons above. However, Hsu does not teach the specific metal hydride substrate.

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In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific metal hydride substrate of Deublein et al in the proton conductor material of Hsu as Deublein et al teach that these metal hydride substrates are material not forming hydrogen-blocking surface oxide layers in electrolyte environment. Accordingly, these materials are immune to reaction with the electrolytic environment and thus, do not form blocking interfacial oxide layers. Further, the reaction of metals and alloys with hydrogen is of great technical importance to a variety of current and potential industrial application as a fast reaction with hydrogen is desirable for the transport of hydrogen through membranes to separate it from other gases in fuel cell applications.

16. Claims 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Crome et al 5985113 as applied to claim 3 above, and further in view of the publication "Hydrogen-transparent metal surfaces produced by use of molten salts with very low oxygen and water activities" by Deublein et al (hereinafter referred to as "Deublein et al's publication").

Crome et al are applied, argued, and incorporated herein for the reasons above. However, Crome et al do not teach the specific metal hydride substrate.

The Deublein et al's publication teaches metal hydride materials not forming hydrogen blocking surface oxide layers in electrolyte environments (ABSTRACT). Such materials are palladium (Pd), LaNi<sub>5</sub>, titanium(Ti)-vanadium (V) (2<sup>nd</sup> and 3<sup>rd</sup> paragraph of the publication).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific metal hydride substrate of Deublein et al in the proton conductor material of Crome et al as Deublein et al teach that these metal hydride substrates are material not forming hydrogen-blocking surface oxide layers in electrolyte environment.

Accordingly, these materials are immune to reaction with the electrolytic environment and thus, do not form blocking interfacial oxide layers. Further, the reaction of metals and alloys with hydrogen is of great technical importance to a variety of current and potential industrial application as a fast reaction with hydrogen is desirable for the transport of hydrogen through membranes to separate it from other gases in fuel cell applications.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (703) 306-3326. The examiner can normally be reached on Monday-Thursday (8:30 am - 7:00 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (703) 308-2383. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

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Raymond Alejandro

Examiner

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A handwritten signature in black ink, appearing to be 'RAM', written over the printed name and title.